

What is claimed is:

## 1. A display device, comprising:

pixel display holding circuits, sensors, and binary data output circuits which output binary data corresponding to outputs of said sensors, each being provided for each pixel formed on an insulation substrate in matrix form;

a serial output circuit which outputs serial data corresponding to outputs of pixels, said serial output circuit being formed on an outside frame of said insulation substrate; and

an external circuit provided on an outside frame of said insulation substrate, said external circuit having a circuit which generates multi-gradation image based on a plurality of binary image.

## 2. A display device, comprising:

pixel display holding circuits, sensors and sensor output circuits which output outputs of said sensors, each being provided for each pixel formed on an insulation substrate in matrix form;

an A/D conversion circuit formed on outside frame of said insulation substrate, which converts a signal from pixels into digital data;

a serial output circuit formed on outside frame of said insulation substrate, which converts the digital data after A/D conversion into serial data and outputs the serial data;

image capture indication unit which indicates image capture at a plurality of conditions; and

an external circuit provided outside of said insulation substrate, said external circuit having a multi-gradation image synthesizer unit which synthesizes a multi-gradation image based on image consisted of a plurality of few bits.

## 3. A display device, comprising:

pixel display holding circuits, sensors and binary data output circuits which output binary data corresponding to outputs of said sensors, each being provided for each pixel formed on an insulation substrate in matrix form;

an A/D conversion circuit formed on an outside frame of said insulation substrate, which converts a signal from pixels into digital data;

a serial output circuit formed on the outside frame of said insulation substrate, which outputs serial data corresponding to digital data after A/D conversion;

an image capture indication unit which indicates image pickup at a plurality of conditions; and

an external circuit provided outside of said insulation substrate, said external circuit having a synthesizer unit which synthesizes a multi-gradation image based on a plurality of binary image.

4. A display device, comprising:

display elements formed in vicinity of intersections of signal lines and scan lines aligned vertically and horizontally;

image pickup units provided corresponding to each of said display elements by at least one piece, each converting incident radiation at predetermined range into an electric signal;

electric charge accumulators which accumulate the electric charge in accordance with the electric signal converted by said image pickup units; and

signal processing unit which generates digital image data corresponding to image picked up by said image pickup unit, based on accumulated electric charge of said electric charge accumulator for each of a plurality of image pickup conditions.

5. The display device according to claim 4, further comprising a binary data generation unit which outputs

binary data indicating whether or not electric charge accumulated in said electric charge accumulator is equal to or more than a prescribed value,

wherein said signal processing unit generates said digital image data based said binary data obtained for each of a plurality of image pickup conditions.

6. The display device according to claim 5, further comprising an image pickup condition switch unit which switches said image pickup condition in stages in ascending or descending order,

wherein said signal processing unit generates digital pixel data of an attention pixel based on said binary data of a plurality of pixels surrounding the attention pixel when said image pickup condition switch unit switches said image pickup condition for one stage, and logic of said binary data changes.

7. The display device according to claim 6,

wherein said image pickup switch unit switches the amount of initial electric charge accumulated in said electric charge accumulator in stages in ascending or descending order; and

wherein said electric charge accumulator accumulates the remaining electric charge obtained by subtracting electric charge in accordance with the amount of light received by said image pickup unit from initial electric charge.

8. The display device according to claim 6,

wherein said image pickup condition switch unit switches image pickup time of said image pickup unit in stages in ascending or descending order.

9. The display device according to claim 6,

wherein said signal processing unit sets an average

value of said binary data at previous image pickup time for 8 pixels surrounding the attention pixel as digital pixel data of said attention pixel when said image pickup switch unit switches said initial electric charge amount for one stage, and logic of said binary data changes.

10. The display device according to claim 5, further comprising:

a temporary storing unit which temporarily stores said binary data at one image pickup condition; and

a work storing unit having a first area which stores said binary data stored in said temporary storing unit and a second area which stores said digital pixel data corresponding to binary data stored in the first area.

11. The display device according to claim 10, wherein said display element, said image pickup unit, said electric charge accumulator and said binary data generator are formed on the same insulation substrate; and

wherein said signal processing unit, said temporary storing unit and said work storing unit are formed on a semiconductor substrate different from said insulation substrate.

12. A display device, comprising:

display elements formed in vicinity of intersections of signal lines and scanning lines aligned vertically and horizontally;

image pickup units provided corresponding to each of said display elements by at least one piece, each converting incident radiation at predetermined range into an electric signal;

electric charge accumulators which accumulate the electric charge in accordance with the electric signal converted by said image pickup units;

image pickup data amplifier which amplifies binary

data in accordance with accumulated electric charge of said electric charge accumulation unit;

an average gradation detection unit which detects average gradation of an image pickup object based on the binary data amplified by said image pickup data amplifier;

a brightness setting unit which sets display brightness of said display element in the case where said image pickup unit performs image pickup, based on detection result of said average gradation detection unit;

an image pickup time controller which controls switching of a plurality of image pickup times of said image pickup unit; and

an image data generation means which generates digital image data corresponding to pickup image based on image pickup result of said image pickup unit at each pickup time controlled by said image pickup time controller at a state of display brightness set by said brightness setting unit.

13. The display device according to claim 12,

wherein display brightness setting based on said average gradation is performed at each block consisted of a plurality of adjacent display elements.

14. The display device according to claim 12, further comprising:

an image pickup time detection unit which detects image pickup time of said image pickup unit where the average gradation detected by said average gradation detection unit becomes a prescribed reference gradation for each block,

wherein said brightness setting unit sets brightness of said display elements based on detection result of said image pickup time detection unit.

15. The display device according to claim 12,

wherein said image data generator performs a weight

processing with regard to image pickup result of said image pickup unit for each image pickup time.

16. The display device according to claim 12, further comprising:

a scan line drive circuit capable of switching line order drive of the scan lines or simultaneous drive of all the scan lines,

wherein said scan line drive circuit simultaneously drives all the scan lines when initial electric charge is accumulated in said electric charge accumulation unit.

17. The display device according to claim 12, further comprising:

a data count unit which counts the number of "0" or "1" included in said serial data,

wherein said average gradation detection unit detects the average gradation based on count result of said data count unit.

18. The display device according to claim 13,

wherein said brightness setting unit sets brightness of said display elements located at a center position of said blocks, and brightness of said display elements except for the center position of said blocks is gradually changed in accordance with a distance from the center position.

19. A display apparatus, comprising:

display elements formed in vicinity of intersections of signal lines and scan lines aligned vertically and horizontally;

image pickup units provided corresponding to each of said display elements by at least one piece, each converting incident radiation at predetermined range into an electric signal;

electric charge accumulators which accumulate the

electric charge in accordance with the electric signal converted by said image pickup units;

image pickup data amplifiers which amplify binary data in accordance with the accumulated electric charge of said electric charge accumulator;

a reference pattern storing unit which stores a plurality of reference patterns indicating display format of blocks consisted of a plurality of display elements;

a reference pattern selector which selects a plurality of reference patterns approximate to image pickup result of said image pickup unit; and

an image data generation means which generates digital image corresponding to pickup image based on the result repeatedly picked up by said image pickup unit while displaying the reference patterns inverting brightness of the reference pattern selected by said reference pattern selector.

20. A display device, comprising:

display elements formed in vicinity of intersections of signal lines and scan lines aligned vertically and horizontally;

image pickup units provided corresponding to each of said display elements by at least one pieces, each converting incident radiation at predetermined range into an electric signal;

electric charge accumulators which accumulate in accordance with an electric signal converted by said image pickup unit;

image pickup result storing units which temporarily store a signal in accordance with the electric charge accumulated in said electric charge accumulator; and

output switching controllers which switches whether or not to output the signals stored in said image pickup storing unit, in accordance with logic of a control signal line,

wherein at least portion of said control signal line is arranged so as to be overlapped with a power supply line of said image pickup result storing unit.

21. A display device, comprising:

display elements formed in vicinity of intersections of signal lines and scan lines aligned vertically and horizontally;

image pickup units provided corresponding to each of said display elements by at least one pieces, each converting incident radiation at predetermined range into an electric signal;

electric charge accumulators which accumulate in accordance with an electric signal converted by said image pickup unit;

image pickup result storing units which temporarily store a signal in accordance with the electric charge accumulated in said electric charge accumulator; and

output switching controllers which switches whether or not to output the signals stored in said image pickup storing unit, in accordance with logic of a control signal line,

wherein resistances of power supply lines of said image pickup result storing units are set to be lower than that of output lines of said output switching controllers.

22. A display device, comprising:

display elements formed in vicinity of intersections of signal lines and scan lines aligned vertically and horizontally; and

sensors provided corresponding to each of said display elements by a plurality of pieces, which receive incident radiation at ranges different from each other and accumulate electric charges in accordance with the received light,

wherein each of said sensors has:

a photoelectric converter which outputs an electric

signal in accordance with received light;

an electric charge accumulator which accumulates the electric charge in accordance with said electric signal;

an initial controller which switches whether or not to accumulate an initial electric charge in said electric accumulator; and

an output controller which switches whether or not to output the signal in accordance with the accumulated electric charge of said electric charge accumulator.

23. A display device, comprising:

display elements formed in vicinity of intersections of signal lines and scan lines aligned vertically and horizontally, said display elements constituting a display screen;

sensors provided in said display screen; and

A/D converters which convert output signals of said sensors into digital signals, said A/D converters being formed an outside frame portion of an insulation substrate on which said signal lines, said scan lines, said display elements and said sensors are formed.

24. A display device, comprising:

display elements formed in vicinity of intersections of signal lines and scan lines aligned vertically and horizontally;

sensors provided corresponding to said display elements;

A/D converters which convert output signals of said sensors into digital signals; and

a shift register which converts said digital signals into serial signals and outputs the serial signals,

wherein said shift register has:

a first shift register which converts said digital signal of  $m$  ( $m$  is an integer equal to or more than 2) bits into a first serial signal and outputs the first serial

signal;

a second shift register which converts said digital signal of  $n$  ( $n$  is an integer equal to or more than 2) bits into a second serial signal and outputs the second serial signal; and

a serial signal selector which selects either of said first or second serial signal and outputs the selected signal.

25. A display device, comprising:

display elements formed in vicinity of intersections of signal lines and scan lines aligned vertically and horizontally on an insulation substrate;

sensors provided on said insulation substrate, said sensors corresponding to said display elements;

A/D converters formed on said insulation substrate which converts output signals of said sensors into digital signals;

a plurality of shift registers formed on said insulation substrate which converts said digital signals into a first serial signal and output the first serial signal;

a serial signal selector formed on a substrate different from said insulation substrate which selects either one of a plurality of first serial signals outputted from said plurality of first shift registers and outputs the selected signal; and

an S/P converter formed on a substrate different from said insulation substrate which converts the output signal of said serial signal into a plurality of second serial signals corresponding to said first serial signals.